

ANCIENT EGYPTIAN MEDICINE AND PALAEOPATHOLOGY:

SCIENTIFIC STUDIES ON DISEASE, LIFESTYLE AND TREATMENT

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EGYPTIAN MEDICINE

A combination of rational and irrational treatments:

- objective, scientific medicine based on observation of the patient, bedside experience and knowledge of anatomy. Cause is usually visible
- Magical procedures: illness caused by vengeance of the dead, gods' punishment, malevolence of enemies

EGYPTIAN MEDICINE

Components of “magical” treatment:

- **SPELL**: spoken word can effect a cure
- **RITUAL**: acts and gestures accompany spell; can be performed on patient or figurine. Used **amulets**, wine, oil, water
- **PRIEST/magician/doctor**: carried out treatment



AMULETS (Magical Jewellery)

Used by the Egyptians to bring health and protection to the living and the dead

EGYPTIAN MEDICINE

GODS OF MEDICINE



- SEKHMET: the destroyer
- THOTH: invented healing formulae
- HORUS and AMUN: eye diseases
- TAUERT: fertility and childbirth
- IMHOTEP (Gk. Aesculapius): founder of medical science

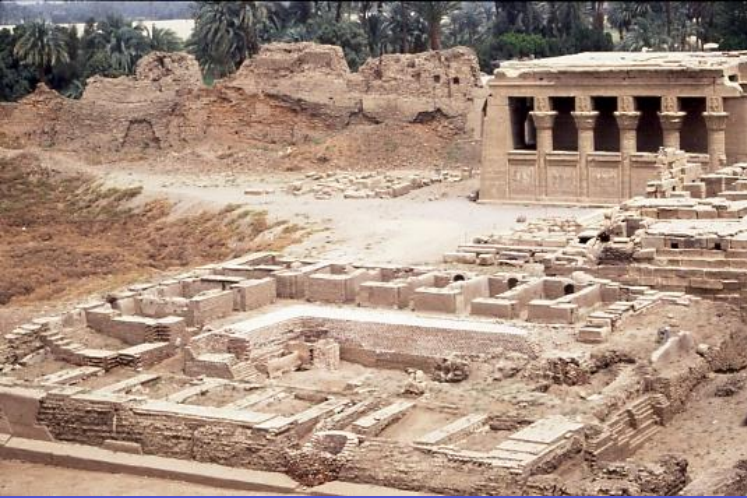
TEMPLES: CENTRES OF HEALING

EGYPTIAN MEDICINE



- Some had reputation for cures. Most famous: Denderah, Deir el-Bahri, Memphis
- Healing methods: cleansing with sacred water and incubation (“temple sleep”)
- Occurs in Greek temples (Kos and Epidauros) but much earlier in Egypt

EGYPTIAN MEDICINE



SANATORIUM AT DENDERAH

- Only one identified and excavated in Egypt
- Attached to main temple
- Cells to accommodate patients
- Prepared for the “Therapeutic Dream”

EGYPTIAN MEDICINE

THE THERAPEUTIC DREAM

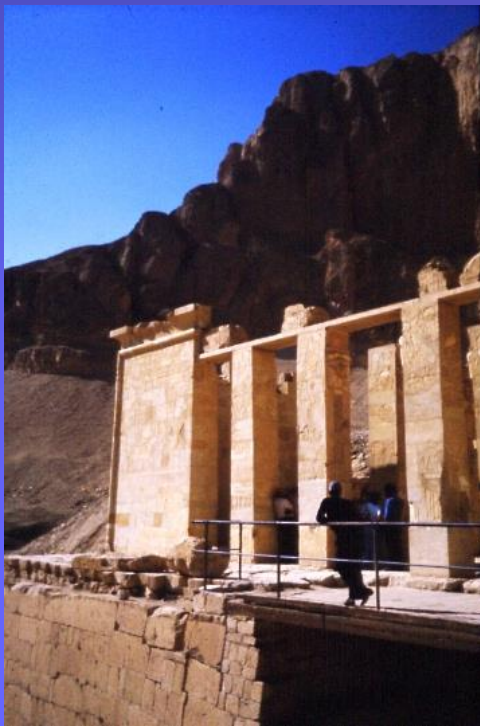
- Prepared in isolation in small, dark room
- Trance state induced with lamps, burning perfumed wood, and sacred songs
- Patient's soul entered Nun (place where gods dwelt)
- Goddess Isis appeared and treated patients for physical and mental afflictions
- Patients could approach the gods and gain insight into their own futures and could attain healing

EGYPTIAN MEDICINE

TEMPLE OF DEIR EL-BAHRI: Resort for Invalids



- Cults of Imhotep and Amenhotep, son of Hapu
- Patients' inscriptions on colonnade:



“Andromachos, a Macedonian, a worker for hire, came to the good god; he was sick, and the good god succoured him, on that very day.”

EGYPTIAN MEDICINE



MEDICAL PERSONNEL

- Priests of Sekhmet (*wabau*): temple-based physicians
- General practitioners (*swnw*) attached to building sites, armies, burial grounds, royal palaces
- Magicians (*sau*)
- Aides: nurses, masseurs, bandagers

EGYPTIAN MEDICINE

TRAINING:

- Little known. Association with “House of Life” – may be medical school

TREATMENT OF THE SICK:

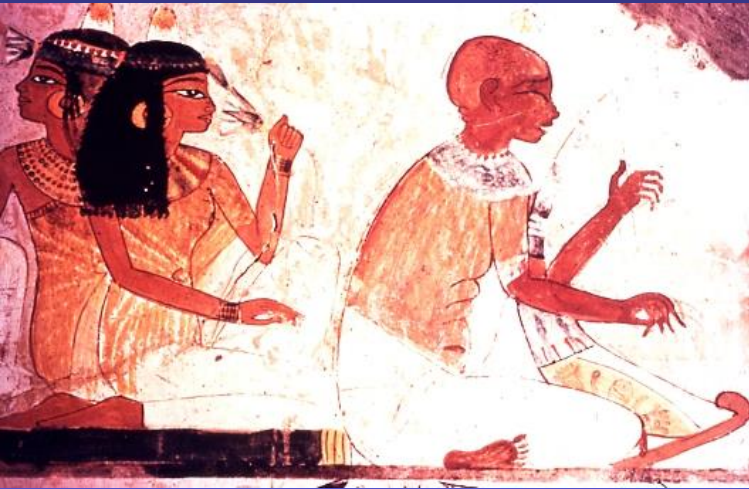
- All patients well treated
- Doctor prohibited to divulge secrets
- Examination and questioning of patient followed by diagnosis, or “moored at his stakes” and then re-examined

EGYPTIAN MEDICINE



- SOURCES OF EVIDENCE:
- MEDICAL PAPYRI
- 12 major Medical Papyri
- Most date from c.1550 BCE
- Several functions: handbooks for doctors' daily use; outlines of medical lectures; records of instruction
- No unity of subject or composition
- Case studies: list symptoms, diagnosis, prescribed treatment, and prognosis
- Contain both rational and irrational treatments
- Show great complexity of Egyptian medicine

EGYPTIAN MEDICINE



- SOURCES OF EVIDENCE
- Tomb scenes
- Doctors' tomb-stones (stelae)
- Surgical instruments
- Scene of “surgical” instruments at Temple of Kom Ombo
- Mummified remains

EGYPTIAN MEDICINE: Main Concepts

- “*Metw*”: bodily conduits to carry fluids. Included vessels, canals, ducts, nerves
- Based on vision of Egypt with its river and canals
- Obstructions caused “floods” and “droughts”: illness eliminated in the excreta
- Heart regarded as seat of thought and emotions, and centre of the network of “*metw*”

EGYPTIAN MEDICINE:

Methods of Treatment

SURGERY:

- Treatment of wounds
- Dislocations and fractures
- Treatment of tumours: “tumours of Khonsu”
- Trepanation
- Circumcision

ANASTHESIA:

Narcotics, alcohol, etc.

EGYPTIAN MEDICINE: Methods of Treatment



PHARMACY

PRINCIPLES:

- Disagreeable substances (excrement, urine) would expel evil spirits from patient
- Aromatic oils could attract good gods

METHODS:

- Mineral drugs: gold, silver, precious stones
- Vegetable/plant products
- Animal products
- “Transfer” ritual: transfer of migraine pain to a fish

EGYPTIAN MEDICINE: Particular Aspects



DENTISTRY:

- Attrition but little caries
- Due to the diet
- Probably no specialised profession

GYNAECOLOGY AND OBSTETRICS:

- Fertility and pregnancy tests
- Contraceptive measures
- Use of birth stools



EGYPTIAN MEDICINE: Achievements

- Origin of most medicine and pharmacy in Europe and Near East: passed on through Greeks and Arabs
- Firsts:
 - observations in anatomy;
 - anatomical and medical vocabulary;
 - use of splints, bandages and compresses;
 - experiments in surgery and pharmacy;
 - use of sanatoria and isolation for treatment of mentally and physically sick
- Greek physicians practised systematic dissection in Alexandria when religion and popular opinion prohibited it in Greece

EGYPTIAN MEDICINE: Conclusions

- Mummification familiarised people with the concept of autopsy
- Considerable advances but irrational treatments continued alongside rational methods:

Treatment for the common cold

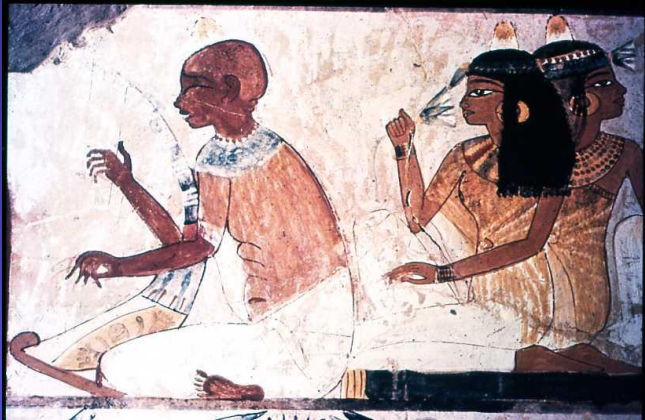
“Flow out fetid nose, flow out, son of fetid nose! Flow out, you who destroy the skull, and make ill the seven holes of the head!”

EGYPTIAN MEDICINE

“The Egyptians were the first in history to dare to look at the other side of the abyss which separates magic from science”

P.Ghalioungui

SIGNIFICANCE OF BIOMEDICAL STUDIES TO EGYPTOLOGY



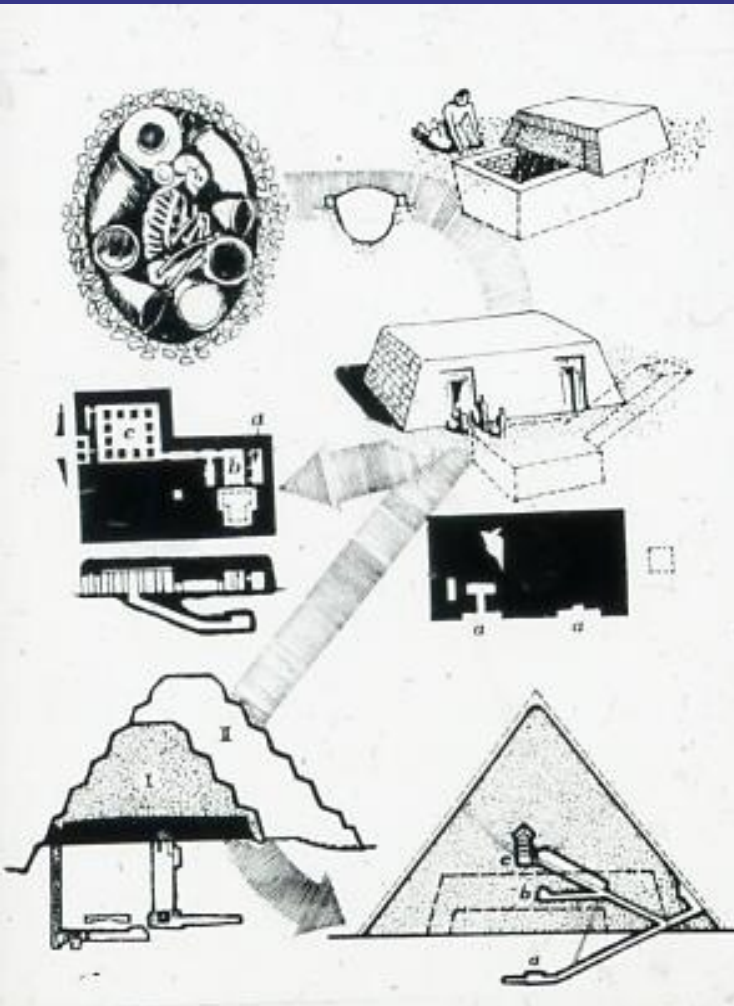
- Wealth of archaeological, art and literary evidence from ancient Egypt
- However, for disease and medical studies, this evidence is often flawed or limited:
- Art: most religious art shows the elite in perfect, idealised form
- Archaeology: limited material has survived (e.g., the Sanatorium, Denderah)
- Literature: only 12 Medical Papyri survive
- Mummified remains provide major source of direct evidence about disease, diet and treatment in ancient Egypt

**MUMMIFICATION:
GEOGRAPHICAL AND
ENVIRONMENTAL
CONDITIONS**



- Egypt and museum collections elsewhere have large numbers of mummies
- Limited cultivatable/habitable land: dead buried in desert in shallow graves
- Hot, dry burial conditions ensured dehydration and preservation of bodies
- Resulted in “natural mummies”

MUMMIFICATION: TOMB DEVELOPMENT



- Introduction of *mastaba* tombs for elite, c.3400 BCE
- Burial in brick-lined chamber no longer provides dehydrating environment: bodies decompose
- Already established belief that spirit returned to preserved body after death
- Trial and error process to develop “intentional” or “true” mummification for the elite
- By c.2800 BCE, intentional mummification (for elite: pyramids, *mastaba* tombs), and natural preservation (for other classes: pit-graves)



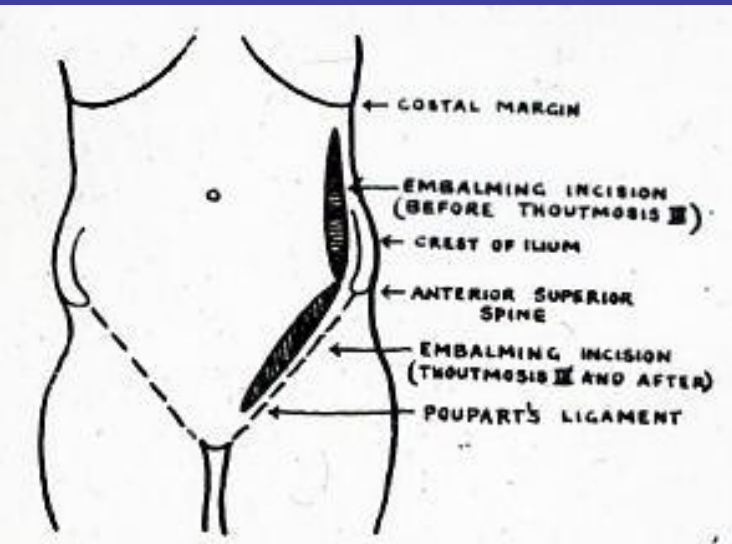
MUMMIFICATION

EXAMPLES OF NATURAL (Left) AND INTENTIONAL (Right)
MUMMIFICATION

MUMMIFICATION: INTENTIONAL TECHNIQUES

TWO MAIN STAGES:
Evisceration and Dehydration

EVISCERATION



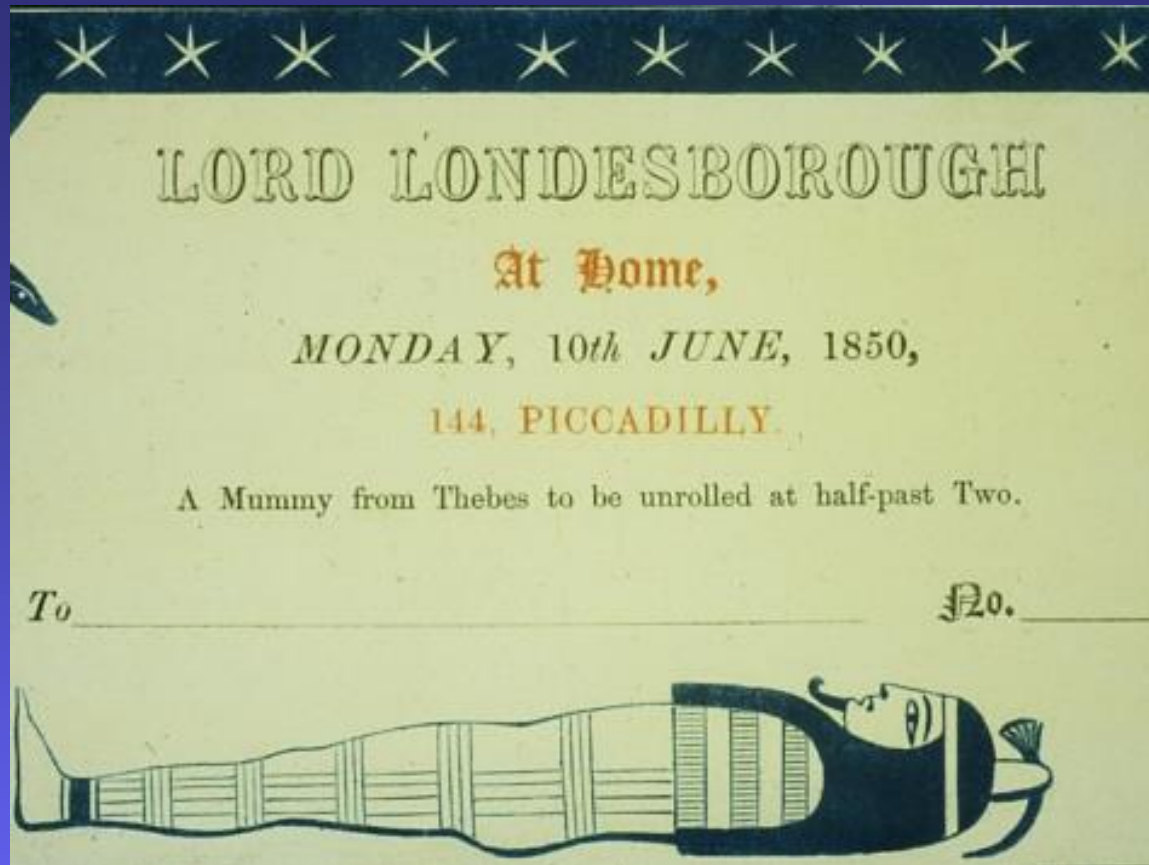
- Removal of viscera from thoracic and abdominal cavities, through flank incision
- Heart and kidneys left in situ
- Excerebration from c.2000 BCE

MUMMIFICATION INTENTIONAL TECHNIQUES



DEHYDRATION

- Body and viscera treated with natron for 40 days
- Natron occurs in natural deposits in Egypt: used as a dehydrating agent
- Once dehydrated, viscera either
 - (a) packaged and returned to bodily cavities or placed on legs of mummy, or
 - (b) placed in Canopic Jars

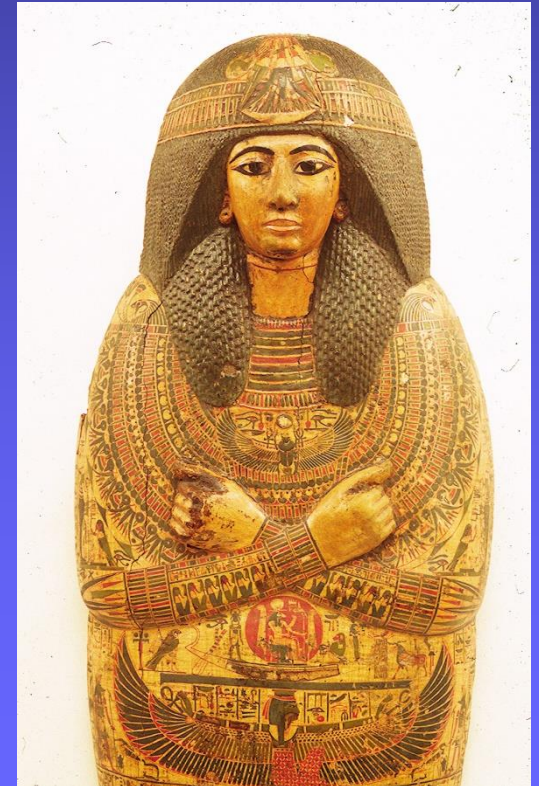


INVITATION TO MUMMY UNROLLING

A frivolous pursuit in Britain and elsewhere in the 18th and 19th centuries

EARLY MUMMY INVESTIGATIONS

- Unrolling of mummies in 18th and 19th centuries
- Loss of evidence
- A few examples of good scientific practice, e.g. “The Leeds Mummy”
- Discontinuation of unrollings



EARLY MUMMIES STUDIES IN MANCHESTER, ENGLAND

- Dr Margaret Murray establishes an interdisciplinary team
- Unwrapping and Autopsy of two Egyptian mummies in the Manchester Museum collection
- Results obtained from this investigation of the mummies of the “Two Brothers”



THE MANCHESTER EGYPTIAN MUMMY PROJECT

- Group of scientists at the University of Manchester formed the Manchester Egyptian Mummy Project in 1973
- This is the longest continuous team project (35 years) in palaeopathology
- From the start the main aims of the Project were:
 - a) To establish a methodology for examining mummified remains
 - b) To use biomedical and scientific techniques to increase knowledge about disease, diet, lifestyle, medical treatment and religious beliefs in ancient Egypt.



THE KNH CENTRE FOR BIOMEDICAL EGYPTOLOGY

- A unique Centre, established in the Faculty of Life Sciences, University of Manchester
- Opened in December 2003 by His Royal Highness Earl of Wessex
- The Manchester Mummy Project forms the basis for the work of the KNH Centre



THE KNH CENTRE FOR BIOMEDICAL EGYPTOLOGY

- Its main focus: an interdisciplinary approach, that combines historical and scientific methodology, to researching disease, medical treatments, lifestyle and mummification techniques in ancient Egypt
- The only university facility where Egyptology can be studied in terms of bio-science
- Teaching and research are based on diagnostic tools that include radiology, histology, immunology and molecular techniques

TECHNIQUES: RADIOLOGY



- Flinders Petrie probably obtained first x-ray of human mummy in 1897
- Scientific value of radiographic investigation only properly recognised since 1960s
- Manchester established methodology in 1970s: under hospital conditions instead of portable equipment
- Fluoroscopy and tomography; CT-scanning
- Possible to determine disease in skeleton and remaining soft tissue
- Information about mummification techniques and funerary customs



RADIOLOGY: CASE STUDY



- Guinea worm infestation found in Mummy 1770
- X-rays showed opacity in anterior abdominal wall
- Removed and x-rayed: calcified remains of male Guinea worm
- Within the human host, male worm dies after impregnating female worm
- Pregnant female worm moves into host's subcutaneous tissue; often perforates skin of legs, forming ulcers, as it tries to leave the body
- Mummy 1770: amputations at knees ante-mortem may have been attempt to remove ulcerated legs caused by Guinea worm infestation

TECHNIQUES: HISTOLOGY, ELECTRON MICROSCOPY AND ENDOSCOPY



- Histology: major advances in rehydrating and fixing mummified tissue
- Then cut into sections and examined by means of light/electron microscopy
- Endoscopy: virtual non-destructive technique for removal of tissue from mummy.
Developed by Manchester team

HISTOLOGY : CASE STUDY - FILARIASIS



- The Leeds Mummy: tissue from scrotal area contained remains of filarial worms
- Carrier is mosquito
- Worms can block lymphatic channels, causing elephantiasis (swelling and thickening of skin)



HISTOLOGY: CASE STUDY – ATHEROSCLEROSIS

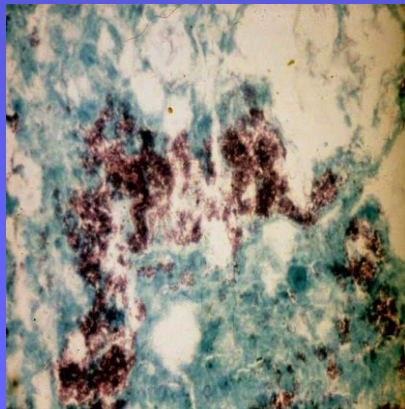


- Leeds Mummy: Plaques of atheroma found in scrotal tissue (femoral blood vessel from groin)
- “Modern disease” related to diet?
- Difference in diet of priests’ families (food from the gods’ altars) and rest of population in ancient Egypt
- Leeds Mummy was “Overseer of the Sacred Cattle” in Temple of Amun, Karnak

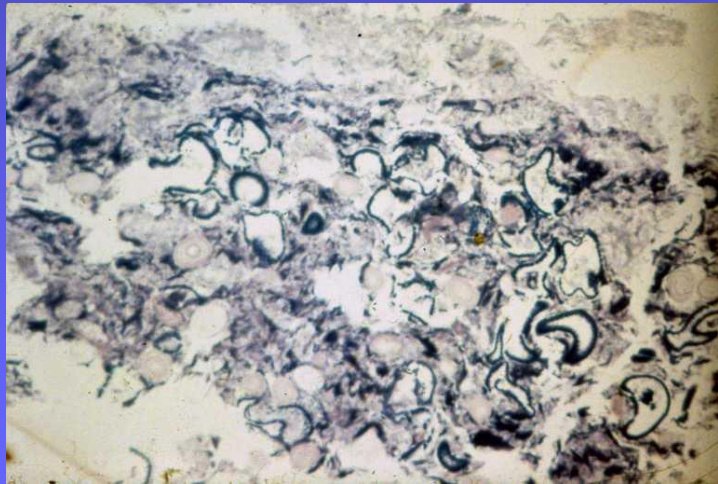
HISTOLOGY AND ELECTRON MICROSCOPY: CASE STUDY – LUNG DISEASE



- Heart and lung tissue from Canopic Jar in Tomb of the Two Brothers (Manchester Museum)
- EM of lung tissue revealed scarred areas with silica particles: Sand pneumoconiosis
- Also pleurisy and (in heart tissue) pericarditis
- Combination probably caused death



**HISTOLOGY AND
ELECTRON MICROSCOPY:
CASE STUDY -
STRONGYLOIDES**



- Asru, Chantress of Amun: larval forms of nematode worm (Strongyloides) identified in lining of intestine and muscular wall
- Parasite invades body through feet; worm lays eggs in human host which pass out through faeces
- EM helped to identify this organism in Asru's viscera

DENTAL STUDIES



- Examination of dry skulls and x-rays of dentitions in mummies
- Pattern of disease: widespread attrition due to diet (“gritty bread”), but little caries in Pharaonic Period
- Lack of attrition in individuals on longterm invalid diet
- Unusual conditions: gemination of two left incisor teeth (upper jaw) and accessory incisor behind

AN UNUSUAL CASE



- Leeds Mummy: mouth could not be closed
- Possible reasons for this:
 - Oral disease
 - Strangulation
 - Reaction to insect bite
- Opportunity to radiograph whole dentition
- Unusual wear pattern on teeth due to
 - Acidic fruit and drinks
 - Overenthusiastic tooth hygiene

SCHISTOSOMIASIS IN ANCIENT AND MODERN EGYPT



- Schistosomiasis Research Project: modern study (Egypt and USA) set up in Egypt to find better methods to prevent, diagnose and treat the disease
- Manchester team invited to study the disease in antiquity to establish an epidemiologic picture of its development over 5,000 years
- Comparison of data from ancient and modern times

SCHISTOSOMIASIS TODAY



- Chronic debilitating disease: affects 200-300 million people in 79 countries
- Body's reaction to causative parasite (schistosome)
- Schistosome needs two hosts (water snail and human) to complete its life cycle
- Major impact on agricultural workforce and economic productivity
- Exacerbated by modern developments: dam building and irrigation schemes have created new breeding sites for snails
- Schistosomiasis Research Project has reduced original number afflicted (c.20 million) in Egypt

SCHISTOSOMIASIS IN ANCIENT EGYPT



- Did the Egyptians diagnose and record this disease?
- The “aaa”-disease mentioned 50 times in medical papyri
- Haematuria (blood in urine) mentioned as a major symptom, but Egyptians may not have identified this disease specifically, since:
 - Schistosome was probably not visible to naked eye
 - Autopsies probably not performed quickly enough to discover this parasite
- However, environmental conditions ensured occurrence of this disease in antiquity, as today



SCHISTOSOMIASIS IN MUMMIES



- Ruffer (1910) observed calcified schistosome in kidneys of 2 mummies
- More recent radiological, histological and immunological (ELISA) techniques have revealed positive results. Examples include:
 - David *et al* (1979): radiologically identified calcification of bladder (classic pathological condition secondary to schistosomiasis infection)
 - Millet (1980): histological identification of parasite in mummy Nakht
 - Miller *et al* (1993): used ELISA to detect presence of circulating anodic antigen (CAA) in 15 out of 23 mummies
 - Deelder *et al* (1989): positive results from skin and brain of naturally mummified predynastic bodies

TECHNICAL RESTRICTIONS

- Restrictions of Radiology:
 - Requires access to expensive hospital equipment
 - Only applicable for full-body mummies, not tissue samples
- Restrictions of Histology:
 - Requires identification of tissue that specifically contains the parasite or eggs

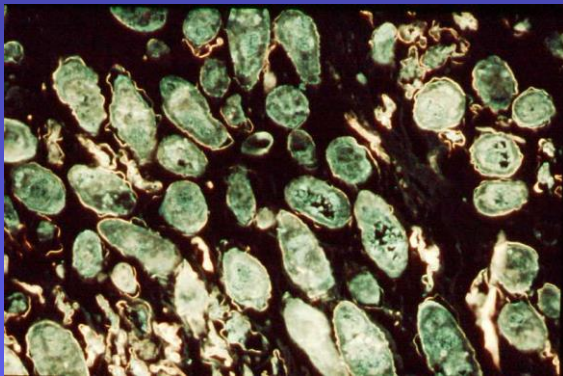
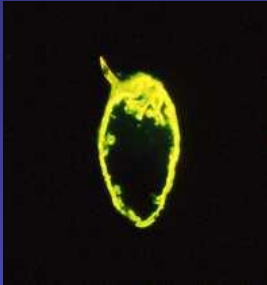


SCHISTOSOMIASIS: MANCHESTER'S CONTRIBUTION



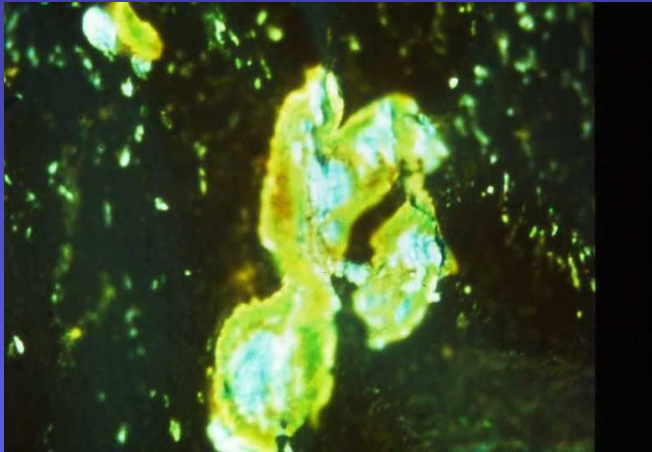
- Establishment of the International Ancient Egyptian Mummy Tissue Bank at Manchester as a resource for this and other studies:
- Ensured availability of a statistically viable supply of tissue samples
- Development of immunocytochemistry as a diagnostic tool to identify schistosomiasis in mummies:
- Relatively cheap procedure that could be applied to large numbers of samples

DIAGNOSING SCHISTOSOMIASIS: IMMUNOCYTOCHEMISTRY



- *S.mansoni* and *S.haematobium* antigens identified in modern mouse tissue
- *S.haematobium* antigens identified in 50-year-old tissue from modern Egyptian cadaver
- Positive immunostaining upon ancient Egyptian tissues indicates that schistosoma antigens survive thousands of years
- Calcification of bladder (classic symptom of urinary schistosomiasis) observed radiologically in Manchester mummy 1766: biopsied tissue sample revealed 2,000-year old male haematobium worm
- First identification of parasite (schistosome) DNA in a mummy
- DNA tests confirm immunological indications

ONGOING AND FUTURE STUDIES



- Application of immunological techniques to diagnose other diseases
- DNA identification: key technical advance is PCR
- Problems with aDNA
 - Current status of aDNA studies:
 - Identify gender
 - Indicate familial relationships
 - Identify parasite DNA
 - Future possibilities
 - Migration patterns of ancient populations
 - Identify bacterial and viral DNA in ancient samples

PHARMACY IN ANCIENT EGYPT PROJECT



- Manchester Methodology (combining historical and scientific approaches), originally developed for disease studies on mummies, extended to investigate ancient Egyptian pharmacy
- Supported by a Research Grant from The Leverhulme Trust
- Innovative, multidisciplinary approach aims to:
 - study pharmaceutical prescriptions in medical papyri and confirm or revise existing translations
 - investigate plant and inorganic remains and identify the plants used in ancient Egyptian pharmacy
 - Identify any traces of pharmaceutical treatments in mummies
 - Determine the accuracy and therapeutic efficacy of ancient Egyptian treatments



PHARMACY PROJECT: RESOURCES



- Access to collections of modern and ancient plants in Britain and Egypt
- International Ancient Egyptian Mummy Tissue Bank
- Cooperation with Medicinal Plant Conservation Project, St Katherine's, Sinai:
- Established 2002 to protect biodiversity in St Katherine's protectorate and sustain medicinally important plants
- Involvement of local Beduin: vital knowledge to identify medicinally useful plants
- Assessment of similarities and differences between modern traditional medicine and therapies in ancient papyri
- Will identify any continuous pharmaceutical tradition from ancient to modern times

PHARMACY PROJECT: Some Questions and Answers



- Molecular Studies:
- Can DNA techniques be used to investigate plant-based therapies administered to treat conditions found in mummies?
- Comparative study of ancient plants and modern strains
- Analytical Studies:
- Analysis of resins and unguents from ancient Egyptian sources (some used medicinally)
- Identification of geographical sources of pharmaceutical samples inside and outside Egypt
- Trade routes into Egypt of some medicinal ingredients (Near East, Libya, Nubia and southern Mediterranean)
- Use of visible light microscopy, environmental scanning electron microscopy and Fourier-transform infrared spectroscopy
- Some Interim Results:
- Increasing evidence that rational, reproducible treatment predominated over “magic”
- 64% of Egyptian prescriptions had therapeutic value on par with drugs used in last 50 years

NEW RESEARCH: THE ULSTER MUMMY LADY TAKABUTI



- Current project: a multidisciplinary research project between The Ulster Museum, Belfast, and the KNH Centre
- Complete study of mummy acquired and unwrapped in 1834
- Mummy of Takabuti, noblewoman and “Mistress of the House”, from Thebes (25th Dynasty)
- Focal feature of the new galleries to be opened at the Ulster Museum in 2009

SIGNIFICANCE OF BIOMEDICAL STUDIES TO HISTORY OF MEDICINE AND PHARMACY



- **UNIQUE CONDITIONS IN EGYPT:**
- Continuous history of population in one location – lends itself to epidemiologic and disease studies over 7,000 year period
- Intentional and natural mummies span all social classes
- Preserved skeletal and tissue remains enable a range of diagnostic scientific techniques to be used
- Ancient and modern plant remains available for study
- Medical papyri: evidence of diagnosis and treatment

Egypt provides an unparalleled opportunity to study the early history of medical and pharmaceutical treatments